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### Research metric analysis of the Aga Khan University Medical College, Karachi on Scopus database 2010-2019

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## **Research metric analysis of the Aga Khan University Medical College, Karachi on Scopus database 2010-2019**

### **Abstract:**

This paper analysis the research output of the faculty, staff and researchers affiliated to the Aga Khan University (AKU) Medical College, Pakistan from 1st January 2010 to 31st December 2019. The paper maps AKU research by analyzing publications by authors with Aga Khan University institutional affiliation that are indexed in Scopus, a citation database of the peer-reviewed literature. Researchers rely on data from Web of Science, Scopus and Google Scholar to assess scholarly communication. However, this study choose Scopus as it is one of largest multidisciplinary databases covering over 23000 journal titles in comparison to Web of Science which covers approximately 9,000 journals. This paper is unique as it provides a holistic view of the Aga Khan University Medical College research by using scientometrics methods to demonstrate trends in high-impact publications along with citation analyses of articles, h-index, journal rank, and impact factor.

**Keywords:-** Citation analysis, Research publication, Citation management , Medical literature , Citation count, Research output, Research evaluation, impact factor

### **1. Introduction:**

The term Bibliometric was first used in 1969 <sup>1</sup>. According to the American Library Association Glossary of library and Information Science (1983), Bibliometric is “the use of statistical methods in the analysis of body of literature to reveal the historical development of subject filed and pattern of authorship, publication and use”.

Medical literature is diverse in nature and it has higher publication rate as compared to other disciplines. Therefore, it is important to analyse the scholarly contribution of AKU Medical College as research output influences institutional ranking.

AKU was established in Karachi, Pakistan in 1983 and was the first private medical university in Pakistan <sup>2</sup>. Research in AKU’s Medical College in Pakistan covers various health sciences disciplines. The University fosters a scientific approach towards research with emphasis on problems of the developing world, such as investigation of the causes and treatment of childhood diarrhoea, studies of the immunological characteristics of tuberculosis and leprosy, and community-based health systems redevelopment <sup>3</sup>.

For the last three decades, AKU faculty, researchers, residents and medical students have been active in research. AKU was ranked among the top 100 universities for clinical medicine and among the top 200 for public health internationally in the Shanghai Ranking's Global Ranking of Academic Subjects 2019. AKU was the only university in Pakistan ranked in clinical medicine and public health in the top 500 universities. In the HEC ranking, AKU is the leading university among the top Pakistani Medical Universities in Private sector and the leading institution in research publications and citations <sup>4</sup>.

## **2. Related literature:-**

There are three types of Bibliometric trends/performance that the researchers found during the review of the literature.

### **2.1 Journal wise Bibliometric**

Various researchers have previously undertaken bibliometric analysis through the lens of journal wise literature production. Pakistan Journal of Medical Sciences for one decade and identified 1,199 articles of which 1,052 articles (87.7%) had been written by more than one author <sup>5</sup>.

A bibliometric analysis of the Journal of Pakistan Medical Association (JPMA) from 1965 to 2018. The study found approximately 8,521 research items which had been cited 27,800 times. Within this journal, researchers from the Aga Khan University had contributed 1,884 documents which had been cited 9,559 times <sup>6</sup>. Another study reported that AKU was the most research productive institution in the Journal of Pakistan Medication Association (JPMA)<sup>7</sup>.

A recent analysis of the Journal of Pakistan Medical Association for a period of four decades disclosed that Community Medicine was the most popular medical specialty (15.3%). The study also found that the most productive institution was the Aga Khan University in Karachi<sup>8</sup>. The Journal of Ayub Medical College (JAMC) from 1997 to 2006 shown that the Aga Khan University was the highest contributing institution with 47 out of 572 research articles <sup>9</sup>.

### **2.2 Discipline Wise Bibliometric**

The discipline wise bibliometric analysis examines literature on a specific discipline such as Medical and Health Sciences or life sciences. A bibliometric study on the discipline of Microbiology: 2013 to 2017 found that the Aga Khan University had contributed 35 out of 333 papers <sup>10</sup>. A bibliometric analysis of biotechnology reported that

AKU was the 3<sup>rd</sup> ranked institution in the field of Biotechnology<sup>11</sup> with 1,523 publications, 12,031 citations and an h-index of 16.

### **2.3 Institutional Wise Bibliometric**

Haq (2017) Institution wise bibliometric study on the research productivity of King Abdul Aziz University (KSA) and found that 81.1% of the publications had been produced through collaborative research<sup>12</sup>. Similarly, a bibliometric analysis of research contribution of Saudi Arab for a period of 35 years (1980-2014) reported a high level of collaboration between Pakistani and Saudi authors. Pakistan affiliated authors were ranked 8<sup>th</sup> with 1981 (5.6%) of total international collaboration papers. Notably, the Aga Khan University was the top collaborator from Pakistan<sup>13</sup>.

### **3. Research objective:**

The main objective of this paper is to present the Aga Khan University faculty and staff publications performance in Scopus database and to highlight the significance of AKU publications in medical literature. The paper also highlights the research impact of AKU Medical literature in the scholarly world.

#### **3.1 Research questions:-**

- (i) What is the publications rate of the Aga Khan University Medical College?
- (ii) What are the publication trends of the Aga Khan University Medical College faculty members?
- (iii) Which are the top journals where the Aga Khan University researchers publish?

#### **3.2 Research methodology:**

Scopus was used to extract relevant papers published from January 2010 to December 2019 and referencing health sciences with the Aga Khan University Pakistan being the affiliation name of the author. The study presented the key bibliometric indicators such as trends of annual publications, citation analysis of articles, publication counts, h-index, journal rank, and impact factor.

Studies carried out by researchers affiliated to other Aga Khan University campuses (Kenya, Uganda, Tanzania, and United Kingdom) were not included.

### **4 Data analysis:-**

The total number of documents (discussed in detail below) which were published by researchers affiliated to AKU Medical College in Pakistan was 3,707. Out of these, 2,652 were journal articles and 459 were review articles. The other research items i.e. (Letter, Note, Editorial, Book Chapter, Conference Paper and etc.) were published in 1,045 publications / journals.

#### 4.1 Publications types:-

Majority of the publications were articles (n=2652; 71.5%)

Table 1: Publications types

Publication Type	Frequency	Percentage
Article	2652	71.5%
Review	459	12.4%
Letter	195	5.3%
Note	124	3.4%
Editorial	101	2.7%
Book Chapter	89	2.4%
Conference Paper	45	1.2%
Others (Erratum, Shorts Survey, Books, Undefined)	42	1.1%
<b>Total</b>	<b>3707</b>	<b>100%</b>

#### 4.2 Year Wise Publication Rate

Table 2: Year wise publications

Year	No. of publications
2010	286
2011	374
2012	339
2013	352
2014	354
2015	354
2016	435
2017	404
2018	404

2019	405
<b>Total</b>	<b>3707</b>

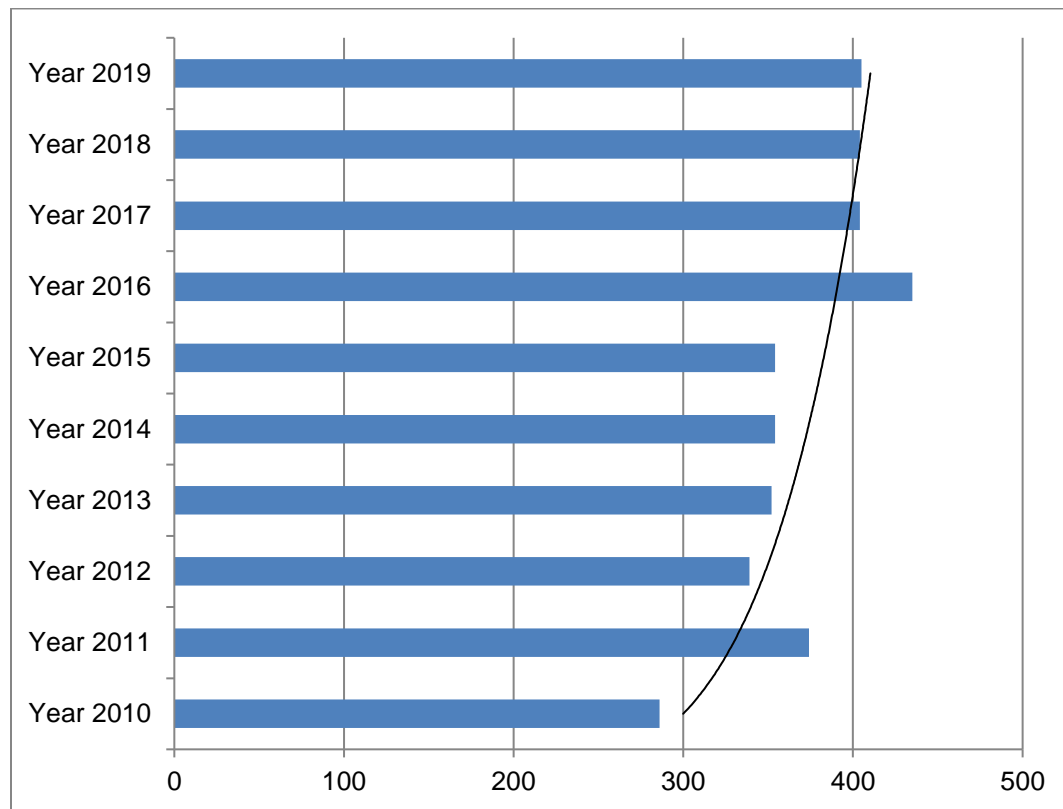


Figure No. 1 Year wise Publications trends

#### 4.3 Analysis of source publications

The researchers affiliated to AKU medical college produced 3,707 documents which were published in 1,045 publications. There were 611 journals (58.5%) with one document each, 177 journals with two documents each and 82 journals with three documents each. The top 10 most frequently published journals are shown in Table 3. The majority of papers (n=430; 11.6%) were published in Journal of the Pakistan Medical Association, followed by The Lancet (n=136; 3.7%) and Journal of the College of Physicians and Surgeons Pakistan (n=106; 2.9%). Amongst the top 10 journals, The Lancet received the highest average citations per paper (ACPP) followed by The Lancet Global Health. More than a quarter of the papers (n=1,057; 28.5%) were published in the top ten journals. The papers received 60,844 (58.7%) of citations with an average of 57.56 citations per paper.

Table 3: Top-10 Journals in terms of publications

S. No.	Name of Journal	Publications	Citations	ACPP
1.	Journal of the Pakistan Medical Association	430	1,132	2.63

2.	The Lancet	136	52,639	387.05
3.	Journal of the College of Physicians and Surgeons Pakistan	106	201	1.90
4.	Reproductive Health	67	976	14.57
5.	BMC public health	66	2,531	38.35
6.	PLoS ONE	59	815	13.81
7.	BMJ Case Reports	58	76	1.31
8.	Pakistan Journal of Medical Sciences	58	163	2.81
9.	The Lancet Global Health	39	2,055	52.69
10.	BMC Research Notes	38	256	6.74

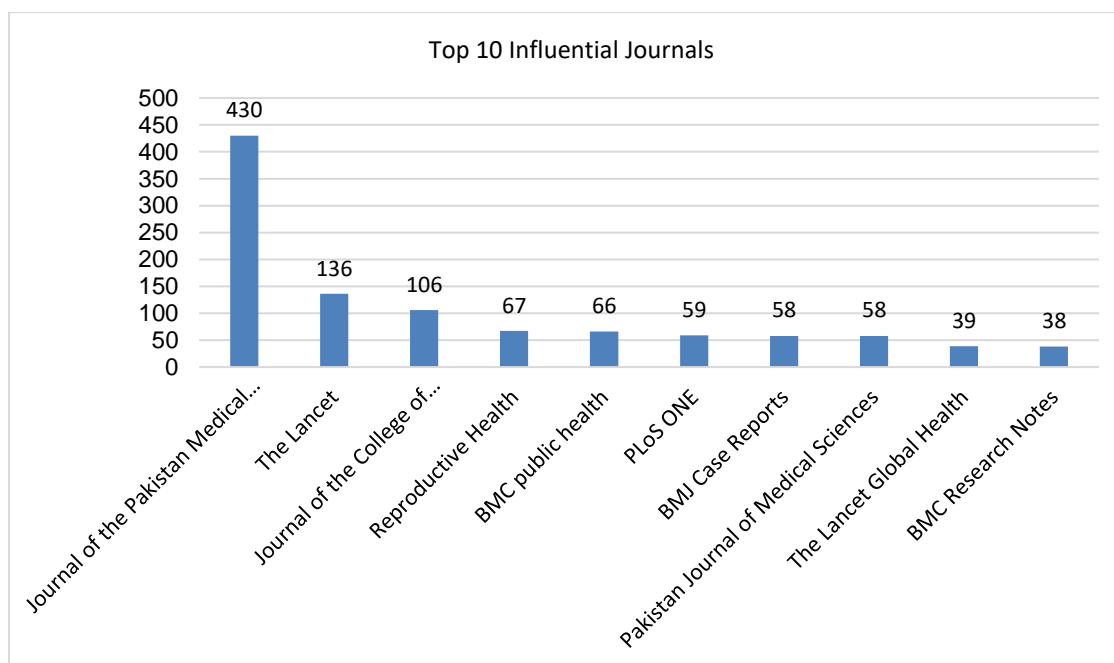


Figure 2: Top 10 Influential Journals

The list of top ten most influential journals in terms of number of average number of citations is shown in Table 4. The number of citations depend on the nature of research along with the visibility and credibility of source publication. The journals having single paper have been excluded from the list. JAMA Oncology received the highest ACPP with 490.67 citations per paper followed by The Lancet (387.05) and Nature Genetics (305.33).

Amongst the top 10 most cited journals, eight had more than 200 ACPP. A total of 189 (5.1%) most influential papers that were published in the ten journals received 64,963 (62.7%) citations.

Table 4: Top 10 Journals in terms of the average citations per paper

S.No.	Journals	Publications	Citations	ACPP
1.	JAMA Oncology	3	1,472	490.67
2.	The Lancet	136	52,639	387.05
3.	Nature Genetics	3	916	305.33
4.	The Lancet Infectious Diseases	14	3,702	264.43
5.	The Lancet Respiratory Medicine	2	435	217.50
6.	New England Journal of Medicine	7	1,478	211.14
7.	The Lancet Gastroenterology and Hepatology	3	625	208.33
8.	Journal of the American College of Cardiology	3	612	204.00
9.	JAMA - Journal of the American Medical Association	10	1,734	173.40
10.	Nature	8	1,350	168.75



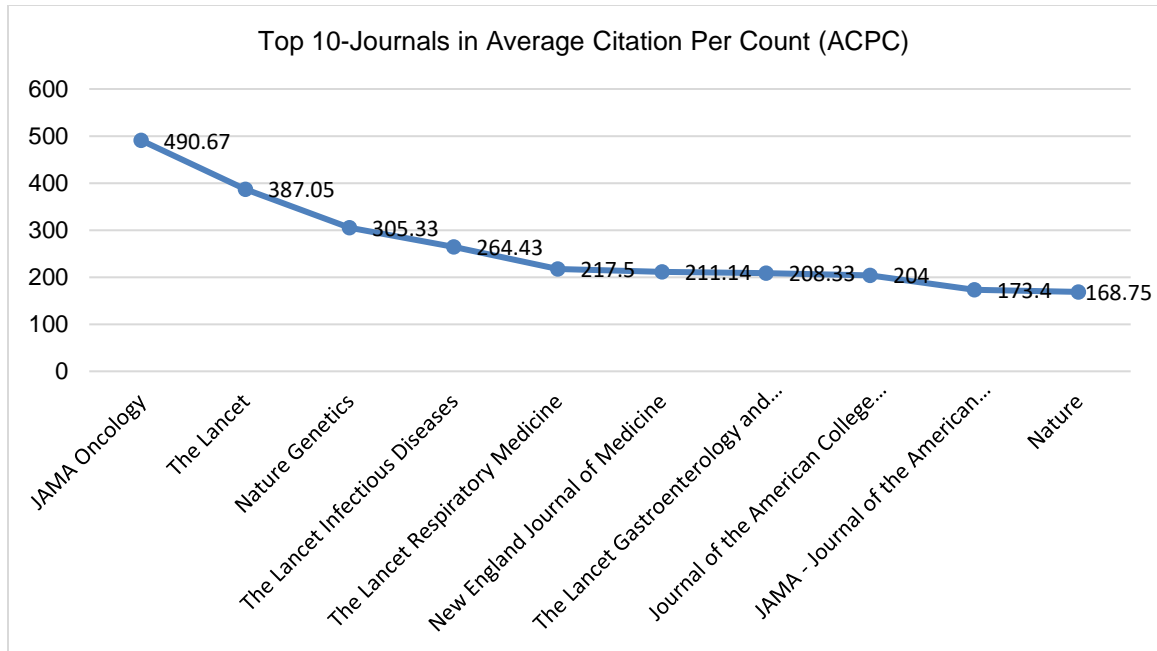


Figure No. 3 Top 10 most average citations counts

#### 4.4 Top 10 most productive authors

The Scopus<sup>14</sup> database indexes all contributing authors and their institutional and country affiliation separately. In case there is at least one author with an affiliation address being The Aga Khan University, this publication would be indexed under Aga Khan University, and the other authors and organizations would be considered as collaborative partners. Amongst the 3,707 papers, the 10 most productive authors along with number of publications was analyzed as shown in Table 5.

Table 5: Top 10 authors in AKU affiliated publications

Rank	Author	Department and Affiliation	Publications
1.	Zufiqar A. Bhutta	Department of Peadiatrics and Child Health, The Aga Khan University Karachi, Pakistan & Hospital for Sick Children University of Toronto, Canada	543
2.	Anita K. M. Zaidi	Department of Paediatrics and Child Health, The Aga Khan University Karachi, Pakistan	87
3.	Naveed Ahmed Khan	Department of Biological and Biomedical Sciences, The Aga Khan University Karachi, Pakistan	78

4.	Jai K. Das	Department of Paediatrics and Child Health, The Aga Khan University Karachi, Pakistan	77
5.	Rehana Rehman	Department of Biological and Biomedical Sciences, The Aga Khan University Karachi, Pakistan	76
6.	Sarah Saleem	Department of Community Health Sciences, The Aga Khan University	69
7.	Omrana Pasha	Department of Community Health Sciences, The Aga Khan University Karachi, Pakistan	67
8.	Zohra S. Lassi	Women and Child Health Division, The Aga Khan University Karachi, Pakistan	65
9.	Rehana Siddiqui	Department of Community Health Sciences, The Aga Khan University Karachi, Pakistan	64
10.	Romaina Iqbal	Department of Community Health Sciences, The Aga Khan University Karachi, Pakistan	61
	Rehana Salam	Department of Paediatrics and Child Health, The Aga Khan University Karachi, Pakistan	61

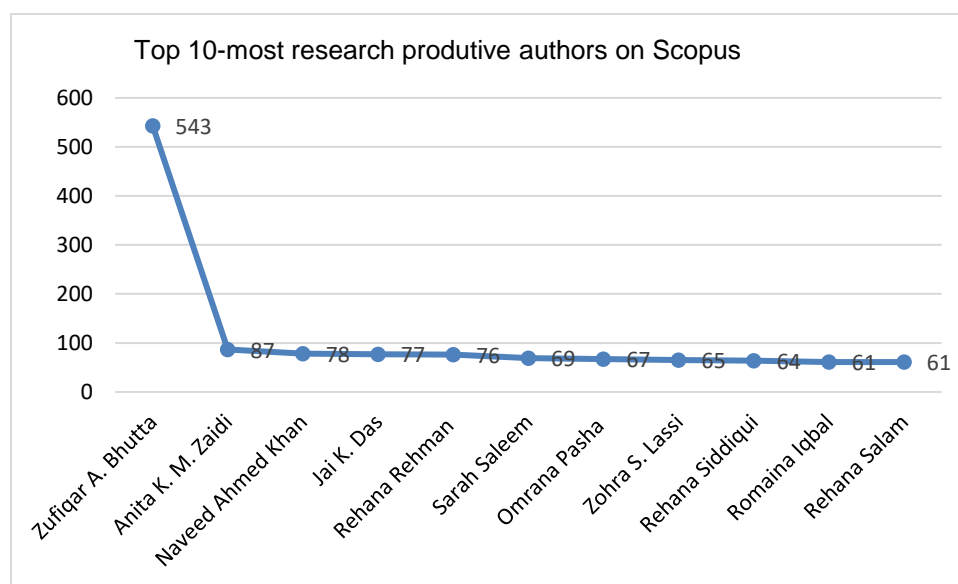


Figure No. 4 Top 10 most research productive author(s) of AKU on Scopus

#### 4.5 Research collaboration

AKU researchers have been actively involved in research collaboration with international authors. Table 5 shows the top 10 frequently collaborative countries for AKU medical college. United States was the top country of

collaboration with 1,049 publications (28.3%), followed by Canada (n=559; 15.1%) and United Kingdom (n=544; 14.7%). There were eight countries in research collaborative process with more than 200 publications each in the targeted period.

Table 6: Most significant countries of collaboration

Rank	Country	Publications	%
1	United States	1,049	28.3
2	Canada	559	15.1
3	United Kingdom	544	14.7
4	Saudi Arab	442	11.9
5	Australia	271	7.3
6	South Africa	264	7.1
7	Bangladesh	230	6.2
8	Brazil	229	6.2
9	Switzerland	221	6.0
10	Kenya	196	5.3

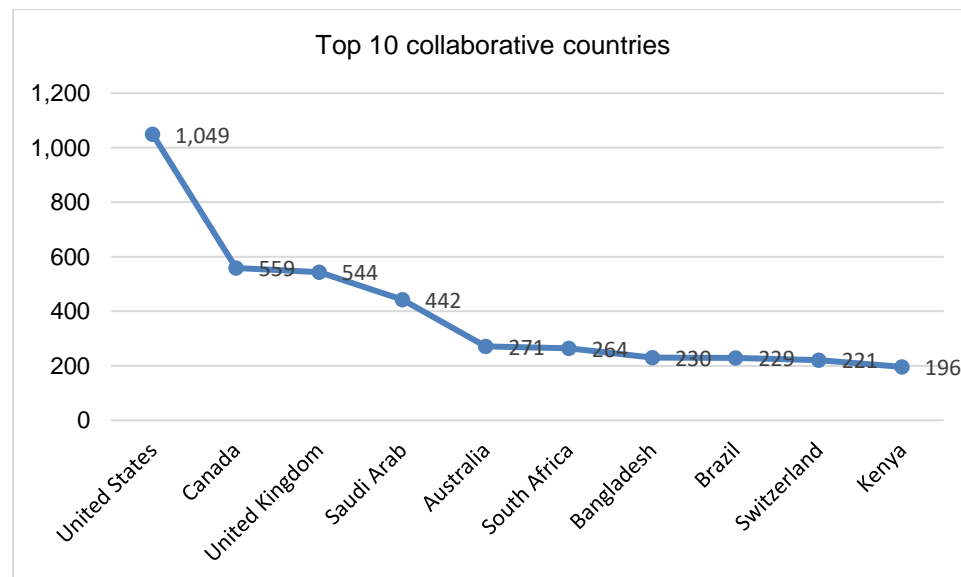


Figure 5: Top 10 collaborative countries

#### 4.6 Publications mode

Of the 3,707 publications, 1,450 (39.1%) were open access articles. The open access articles received 29,485 citations with an average of 20.33 citations per publication. 267 open access articles did not receive any citation.

In total, 2,257 publications (60.8%) were subscription-based and they received 74,163 citations with an average of 32.85 citations per publication. 650 subscription based articles did not receive any citation.

Table 7: Publication mode and citation pattern

Publication mode	No. of publications	Citations	ACPP	Cited publications	Non cited publications
Open access	1,450 (39.1%)	29,485 (28.4%)	20.33	1,183 (81.6%)	267 (18.4%)
Subscription based	2,257 (60.8%)	74,163 (71.6%)	32.85	1,607 (71.2%)	650 (28.8%)
Total	3,707	103,648	27.96	2,790 (75.3%)	917 (24.7%)

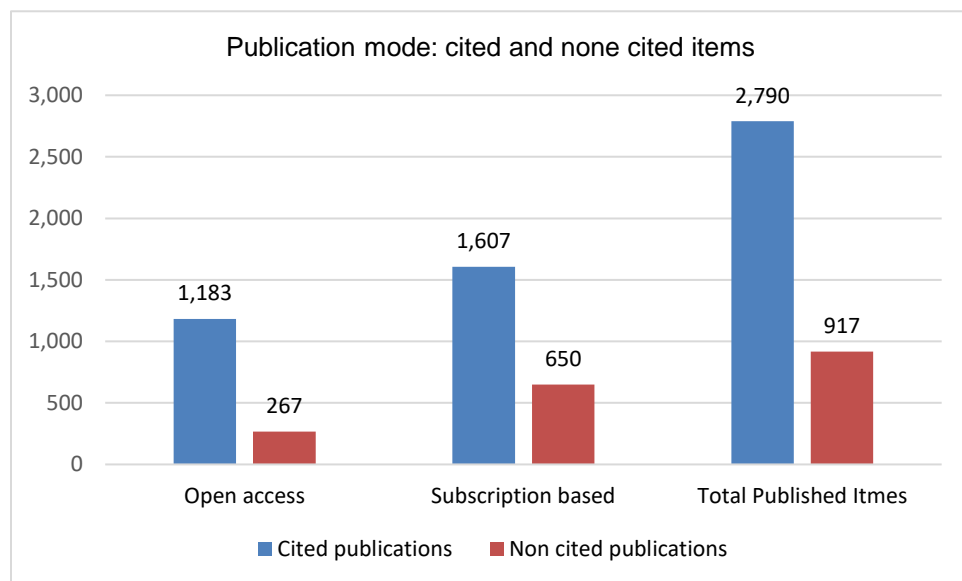


Figure 6: Publications mode - cited and none cited items

#### 4.7 Most cited publications

The list of ten most cited publications is shown in Table 8. The top ten publications obtained more than a quarter of the overall citations (n=27,340; 26.4%). Out of these publications, nine papers were published in one of the top 5 medical journals in the world (The Lancet).

Table 8: Most cited publications

<b>Rank</b>	<b>Title of the publication</b>	<b>Journal</b>	<b>Citations</b>
1.	Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013.	The Lancet. 2014 Aug 30;384 (9945):766-81.	4,996
2.	Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010.	The Lancet. 2012 Dec 15;380 (9859):2197-223.	4,726
3.	Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013.	The Lancet. 2015 Jan 10;385 (9963):117-71	3,505
4.	Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013.	The Lancet. 2015 Aug 22;386 (9995):743-800.	2,614
5.	Maternal and child undernutrition and overweight in low-income and middle-income countries	The Lancet. 2013 Aug 3;382 (9890):427-51.	2,403
6.	Health professionals for a new century: transforming education to strengthen health systems in an interdependent world.	The Lancet. 2010 Dec 4;376 (9756):1923-58.	2,047
7.	Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015.	The Lancet. 2016 Oct 8;388 (10053):1459-544.	1,926
8.	Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015.	The Lancet. 2016 Oct 8;388 (10053):1545-602.	1,839
9.	Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study.	The Lancet infectious diseases. 2010 Sep 1;10 (9):597-602.	1,817

10.	Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): a prospective, case-control study.	The Lancet. 2013 Jul 20;382 (9888):209-22.	1,467
		<b>Total</b>	<b>27,340</b>

#### 4.8 Authorship pattern

A total of 70,077 researchers / authors including multiple count, contributed to 3,707 documents with an average of 37.14 authors per documents. The majority of the documents (n=3,468; 93.6%) were produced through collaborative efforts whereas 239 (6.5%) publications were written by single authors. The Three-author pattern was found to be the most preferred with 547 (14.8%). This was followed by the four-author pattern (n=534; 14.4%). Almost 30% of the publications (n=1,081; 29.2%) were published by three or four-author patterns. The analysis of citations count against each authorship patterns revealed that as the number of authors increased in documents the average citations per paper (ACPP) ratio also increased. Single to six-author patterns received less than 10 citations per paper while the authorship pattern ranging from 10-29 authors received 46.51 citations per paper. The highest number of citations (n=42,126; 40.7%) was received by 102 papers written through collaborative efforts of more than 100 authors with an average of 413 citations per papers. These papers focused on the global data of various diseases.

Table 9: Authorship patterns

S.No.	Authorship pattern	Number of publications (%)	Citation (%)	ACPP*
1	Single-author	239 (6.5%)	565 (0.5%)	2.36
2	Two-author	441 (11.9%)	3,266 (3.2%)	7.40
3	Three-author	547 (14.8%)	3,324 (3.2%)	6.07
4	Four-author	534 (14.4%)	4,238 (4.1%)	7.93
5	Five-author	438 (11.8%)	3,529 (3.4%)	8.05
6	Six-author	312 (8.4%)	2,938 (2.8%)	9.41
7	Seven-author	198 (5.4%)	2,895 (2.8%)	14.62
8	Eight-author	136 (3.7%)	1,947 (1.9%)	14.31
9	Nine-author	114 (3.1%)	3,630 (3.5%)	31.84
10	Ten-author	66 (1.8%)	1,283 (1.2%)	19.43
11	11-29 authors	480 (12.9%)	22,327 (21.5%)	46.51
12	30-49 authors	72 (1.9%)	8,066 (7.8%)	112.02

13	50-99 authors	28 (0.8%)	3,514 (3.4%)	125.5
14	>100 authors	102 (2.8%)	42,126 (40.6%)	413.00
	<b>Total</b>	<b>3707</b>	<b>103,648 (37.2%)</b>	<b>27.96</b>

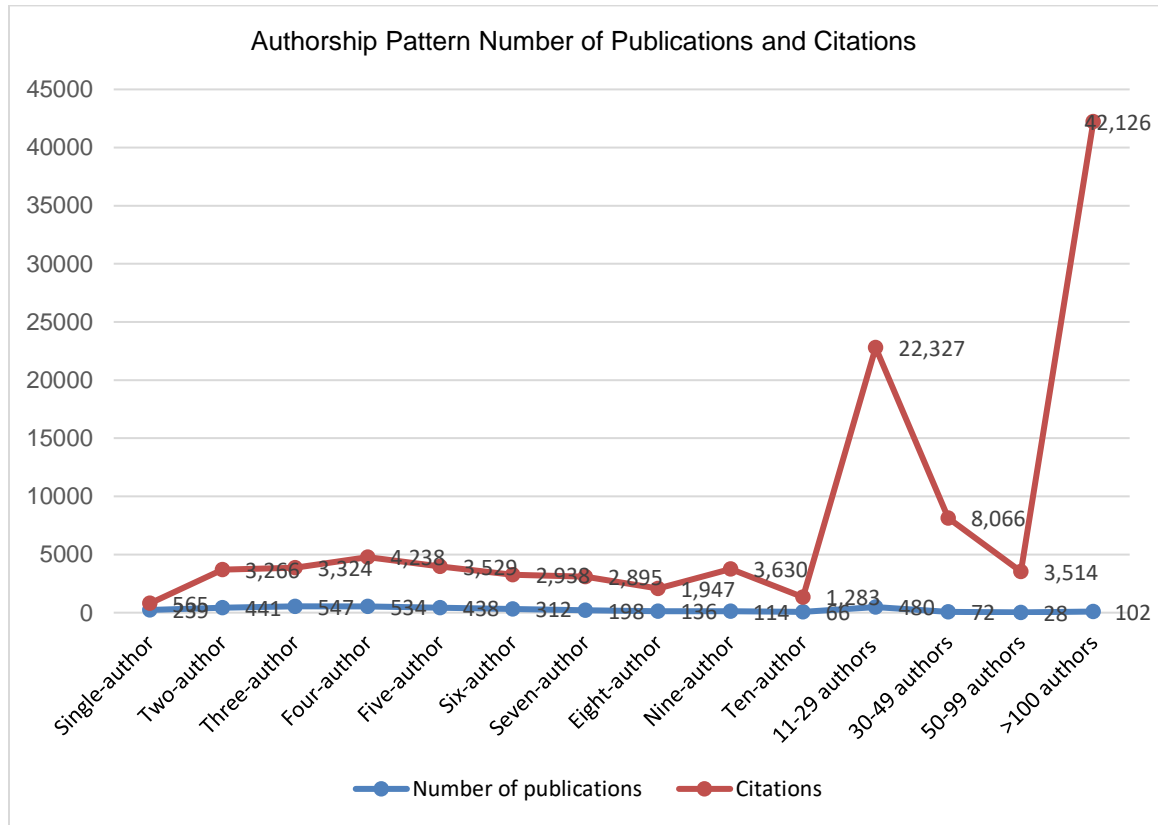


Figure 7: Authorship Pattern - Number of Publications and Citations

## 5. Discussion

As per the research question formulated by the researchers, this paper revealed that on average, AKU Medical College researchers published an average of 370 papers per year. This implies that at least one AKU paper was indexed in Scopus citation database daily.

There was a mix of publication trends as researchers published in international journals with high impact factor and global readership. Majority of the research articles were published in subscription based journals and United States was the top country in terms of collaboration with AKU researchers.

The Higher Education sector uses research metrics as one of the factors in ranking universities. In this aspect, AKU demonstrated an exponential growth in research output with an average citation of 32.85 per article (closed access) and 20.33 per article (open access). Majority of the articles were published in medical journals with impact factor.

AKU authorship pattern for the last ten years demonstrated that only 6.5% of the articles were published in single authorship while majority of the articles were published by more than one author. The author pattern collaborated with the findings of the previous study<sup>10</sup>.

## **6. Conclusion**

In this scientometrics research, we focused on analyzing publications by authors affiliated to the Aga Khan University Medical College in Pakistan. This analysis reveals that AKU medical college has made significant research contribution in the 10 year period of review, 2010 to 2019, with an average of 370 publications per year. Apart from the growth of the average number of articles, the depth and breadth of the research has increased significantly. The authorship pattern disclosed that majority of the articles were published through collaboration. AKU researchers published in high impact journals and majority of the articles received citations (75%).

The study revealed that AKU faculty members, researchers, students and staff continuously engage in research and produce quality literature in the medical and allied health sciences field. The growth in high-impact publications can be attributed to the increase in research funding over the past four years exceeding USD 450 Million per annum including post-graduate training of faculty, student awards, and patient welfare.

This study provides the first inclusive mapping and analysis of scientific research papers published by AKU medical college affiliated researchers. As such, it provides a basis for further work particularly in supporting more in-depth systematic reviews in the developing world context.

## **7. Limitation**

Despite its contributions, the current study had some limitations as it was narrowed to the AKU Medical College in Pakistan. The number of publications and citation count might have increased if other campuses such as AKU Medical College in East Africa were included. The other limitation was on the use of a single citation database (Scopus). Although Scopus provides broad journal coverage, other citation databases such as Web of Science and Google Scholar could be used as well.



The researchers recommend further comparative study of the research output of AKU and other medical colleges in the regions where AKU operates.

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